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## Examining Iowa State University secondary science teacher education program: retention rates and perceptions of graduates from 2000-2002

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**Examining Iowa State University Secondary Science Teacher Education Program:**

**Retention rates and perceptions of graduates from 2000-2002**

by

**Kristen Leigh Campbell**

A thesis submitted to the graduate faculty

in partial fulfillment of the requirements for the degree of

**MASTER OF SCIENCE**

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Program of Study Committee:

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This is to certify that the master's thesis of  
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has met the thesis requirements of Iowa State University

Signatures have been redacted for privacy

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### **Abstract**

Research has shown that teacher shortages in science have been linked to poor retention rates. These retention rates result from inadequate preparation, poor working conditions, and insufficient pay. This study is a very small part of an overarching study that is being conducted to determine the effectiveness of the former (2000-2003) and significantly restructured (2003-2006) Iowa State University secondary science teacher education program (ISU SSTEP). This particular study focuses on the retention rates of the ISU SSTEP graduates from 2000-2002, why some graduates never entered the teaching profession, the reasons graduates give for leaving the teaching profession, and how graduates assess the general and science education components of the former Iowa State University secondary science teacher education program.

## **Chapter 1. Introduction**

### **Rationale for Study**

At the turn of the century the Glenn Commission Report (National Commission on Mathematics and Science Teaching for the 21<sup>st</sup> Century, 2000), wrote of the urgency for America to recruit and prepare science and mathematics teachers. At that time, Olson (2000) wrote that during the next ten to fifteen years, more than 2 million new teachers would be needed in our nation's classrooms. Of those new teachers, nearly one-quarter million will be needed to fill vacancies occurring in secondary science and mathematics.

Science and mathematics teacher shortages are often blamed on university teacher education requirements that are seen as unnecessary impediments to those interested in teaching. For this reason backdoor routes that bypass university-based teacher education are often created for those who want to teach. Although well-prepared teachers are recognized as a valuable resource to communities (NCTAF, 2003), many alternative licensure programs appear to sacrifice teacher quality in order to fill teacher shortage areas.

The ominous wave of retiring teachers does pose a significant challenge to secondary schools throughout much of the United States, particularly in science and mathematics education. However, university teacher education requirements are unfairly blamed for impending shortages. In reality only 60% of those who graduate with teacher licenses ever enter the teaching profession (Darling-Hammond, 2000) and, according to Ingersoll (2001), retirees account for less than 30% of teachers leaving the profession each year.

Science teacher shortages actually result from poor teacher retention that is driven by "inadequate preparation, poor working conditions and insufficient pay" (NSTA, 2003).



According to the National Commission on Teaching and America's Future (NCTAF, 2003), one in three new teachers leave within the first three years of teaching and half leave within five years. The number doubles for those that enter the profession through "backdoors." What this means is that rather than being a cause of the impending teacher shortage, high quality teacher preparation may be crucial for slowing the hemorrhage of teachers who leave the profession early in their careers.

Instead of efforts aimed at bypassing teacher education, the accelerating need for science teachers may be seen as an opportunity to create effective science teacher preparation programs that will fill the profession with highly qualified science teachers who are more likely to remain in the field. Not only are well prepared teachers less likely to leave teaching early in their careers, research indicates that effective teachers are the key component in exemplary science programs (Penick, Yager, & Bonnstetter, 1986). Undeniably, competence in both science content knowledge and in effective pedagogical decision-making are characteristics of exemplary science teachers and accomplishing both requires well thought out teacher education programs. The type of preparation program that a teacher completes is an important factor in their professional development (Krajcik & Penick, 1989; Penick & Bonnstetter, 1989) and impacts their willingness to remain in teaching (LaTurner, 2002; Reynolds, Ross, & Rakow, 2002).

Attacks on the efficacy of teacher preparation programs are made without taking into consideration the wide variety of such programs. For example, secondary science teacher preparation programs vary from those that offer only one general methods course (a course for prospective teachers from all fields) to those that require a series of three or four tightly



coordinated science methods courses (dedicated solely to effective science teaching) and other courses specific to teaching science. Even among programs that have similar structures, what goes on in individual courses varies widely, as does the kind and extent of field experiences.

The type of teacher preparation program can determine how long an individual remains in the teaching profession (Darling-Hammond, 2000; LaTurner, 2002; NCTAF, 2003; Reynolds, Ross, & Rakow, 2001). Determining what these programs are doing differently that later impacts the retention rate of teachers is important for addressing the recurring shortages of science teachers. While teacher retention is a key issue in the debate regarding the efficacy of science teacher preparation programs, more important for improving science education is the effect of such programs on what teachers do in the classroom.

Teacher preparation programs and their graduates need to be carefully studied to identify effective science teacher preparation practices. As Olson (2004) noted, in referring to the Glenn Commission Report (2000), “identifying exemplary programs of teacher preparation around the country, and finding ways to encourage others to multiply their success are basic to [improving teacher preparation]” (p.30). However, research regarding effective science teacher preparation and its effect on teacher retention is not extensive.

### **Research Questions**

The research reported here is one very small piece of a large and ongoing effort by Iowa State University science education faculty and graduate students to study the Iowa State University secondary science teacher education program (ISU SSTEP). This overarching

study is being conducted to determine the effectiveness of the former (2000-2003) and significantly restructured (2003-2006) ISU SSTEP, and does not evaluate nor make judgments on the effectiveness of any individual's science teaching practice. The intent is to compare the effects of the former and new programs, and determine what the current ISU SSTEP does well and what it doesn't do so well, and how it can be improved. In the end, the comprehensive study will include science teachers who completed the ISU SSTEP from the spring 2000 to summer 2006 semesters, and will address the following questions:

1. What is the retention rate ISU SSTEP graduates?
2. For those ISU SSTEP graduates who never taught or no longer teaching, what was their reason for leaving?
3. How do ISU SSTEP graduates assess the general education and science education components of their teacher education program?
4. What educational goals do secondary students of ISU SSTEP graduates perceive are being promoted in their secondary school science classes, and how do those perceptions compare to the science education goals promoted and modeled in the ISU program?
5. What pedagogical decisions and practices do ISU SSTEP graduates exhibit in planning and implementing lessons, and how do those compare to the decisions and practices promoted and modeled in their science teacher education program?

Again, the research reported here addresses only a small portion of the comprehensive study being done by ISU science education faculty and graduate students. An attempt was made to contact individuals who had successfully completed the ISU SSTEP



from the spring 2000 semester through the spring 2002 semester and then graduated from ISU with a science teaching endorsement. The data collected and reported here is relevant to questions one through three, but is merely descriptive with no attempt to provide an answer to these questions. However, the data collected is relevant to the much larger comprehensive study that will be completed in the future by ISU science education faculty and graduate students.



## **Chapter 2. Review of the Literature**

### **Teacher Shortages**

Demand for classroom teachers has always varied, sometimes significantly. With the impending retirement of the baby boom generation, shortages of teachers in the United States, particularly in low-income communities and rural areas, is again a significant issue. While many schools in low socioeconomic areas (e.g. urban and rural) have always had a more difficult time attracting and retaining teachers, shortages in subject areas such as science, mathematics, special education, and bilingual education are now appearing more widely. In an effort to address these shortages, standards for entering the teaching profession are often lowered to quickly fill positions. Backdoors to teaching are increasingly created based on the common and intuitive view that anyone can teach.

Previously, inadequate recruitment had been seen as a major contributing factor to teacher shortages. This may be true in certain states that have little infrastructure for preparing teachers compared to others states that have a large number of teacher education institutions and produce more than they can hire (Darling-Hammond, 2000). However, nationally only sixty percent of new teachers that graduate with a teaching license each year are hired. The remaining forty percent either choose to not enter the teaching profession or cannot find a teaching job. Therefore lack of individuals interested in teaching is not a sufficient explanation for the nation's teacher shortages. As Peske et al. (2001) has noted the diagnosis for teacher shortages has long been mistaken for recruitment when it actually has been the retention of teachers in their profession.



### **Flight from the Teaching Profession**

According to the report by the National Commission on Teaching and America's Future (NCTAF, 2003), one in three new teachers leave the profession within their first three years of teaching and nearly fifty percent leave within five years of teaching. This statistic includes teachers completing any teacher preparation program that results in a license to teach. However, for teachers who enter the profession through "backdoor" or alternative programs, the number that quit doubles within the first three years (Darling-Hammond, 2000).

The science education community also sees its fair share of teachers leaving the teaching profession within the first few years entering the profession. Abundant literature offers explanations as to why teachers leave the teaching profession so soon after entering (NCTAF, 2003; Peske et al. 2001; Darling-Hammond, 2000). Salaries (Darling-Hammond, 2000; Goodlad, 1984), academic capabilities of teacher candidates (Adams and Dial, 1994; LaTurner, 2002), the amount of time demanded of new teachers, and the lack of respect and compensation for teaching (LaTurner, 2002) are reasons teachers typically provide for leaving the teaching profession. LaTurner (2002, p. 662) writes that the "lack of respect for the profession, low salaries, and a fragmented system of teacher preparation" are primarily responsible for the flight from teaching

Teacher pay is a perennial concern for attracting qualified individuals into the teaching profession, and retaining them as they gain the classroom experience that along with a deep understanding of learning and teaching makes for effective teaching. Peske *et al.* (2001) noted that while some new teachers "were disappointed with their pay and working



conditions”, others could not believe how mentally and physically exhausting teaching could be. Pay and working conditions are undeniably major reasons for why many teachers leave the teaching profession.

However, Peske *et al.* (2001), LaTurner (2002), and Darling-Hammond (2000) all note that lack of effective teacher preparation is a crucial reason why so many teachers leave the profession early in their careers. For instance, Darling-Hammond found that for those who left the teaching profession within their first three years of teaching, 60% went through an alternative certificate program, 30% completing a traditional four-year teacher preparation program left, and only 10-15% of teachers completing a five-year teaching education program left. The NCTAF (2003) report noted that, “No research evidence supports the claim that quality teacher preparation, rigorous program accreditation, or strong licensure and certification standards are barriers to providing the nations schools with a sufficient quantity of highly qualified teachers” (NCTAF, 2003). The NCTAF report also claims that the high turnover rates that fuels the current teacher retention rates is aggravated by hiring unqualified and under prepared teachers.

### **Teacher Preparation and Student Achievement**

Standards for teacher licensure vary among states and this influences the type of preparation teachers receive prior to beginning their career. At the secondary level, standards range from requiring only having a minor in the field they teach to demanding an undergraduate major in their primary field of teaching. Some states, like Texas, significantly limit the number of education course that can be required for licensure.



Linking requirements for teacher licensure to how well students achieve is not easy. The variables that must be addressed make drawing relationships between teacher preparation and student achievement difficult. For instance, Darling-Hammond (2000) reported that in 1994,

“high school teachers teaching with both a license and a major in their field ranged from a low of 52% in Alaska to more than 80% in Iowa, Minnesota, Montana, New Hampshire, North Dakota, and Wisconsin – all states that routinely score near the very top of the distribution on rankings of student achievement in reading and mathematics on the National Assessment of Educational Progress (NAEP).”

However, those high-ranking states have homogenous populations that reflect a cultural match between societal expectations and what schools deliver. Those states also have, on average, smaller schools and smaller class sizes. Finally, student achievement in reading and mathematics in the early grades is achieved with elementary teachers who typically major in elementary education rather than a particular discipline such as science, mathematics, history, etc.

LaTurner (2002) reports that qualified teachers (those that have knowledge of subject matter and pedagogy) positively impact students' learning and outcomes. On the other hand evidence shows that teachers that lack preparation for teaching are generally rated inadequate and produce students with lower achievement scores (Darling-Hammond, 2000). More recently, Darling-Hammond *et al.* (2006) studied teachers in Texas and determined that teachers who had completed an approved educator preparation program with appropriate certification examinations were significantly more effective in raising student test scores than teachers without certification or with substandard certification. Not only can qualified teachers (knowledge of subject matter and pedagogy) be linked with student achievement,



but they are also linked to higher retention. Teachers having eighteen or more subject hours in the subject to be taught and extensive educational courses are more likely to remain in teaching for a long period of time compared to teachers that only have a major in their field, are only certified and do not have many hours in their field, or teachers that have neither certification nor a bachelor's degree (LaTurner, 2002). Not only can solid educational preparation positively influence teacher retention rates, but it can also influence how effective teachers are in the classroom (Reynolds, et. al., 2002).

### **Teacher Preparation Programs**

The structure and quality of secondary teacher education programs vary widely. As stated earlier, state standards exert a significant influence on teacher licensure. Typically, licensure programs demand no more than the minimum needed to be accredited. Like many college and university programs, teacher education is often simply a series of courses with little coherence (Goodlad, Soder & Sirotnik, 1990). Prospective teachers often take no more than one course addressing teaching methods, and that one course may be a general methods course for all teachers, rather than a course that addresses content specific methods (e.g. science methods, mathematics methods, social studies methods, etc). Perceiving little relevance or coherence, prospective teachers are left to decide what makes sense and what doesn't. Olson (2003) notes that many preservice students develop a attitude of a child on Halloween night going from course to course receiving education tricks that they can then later decide to use or discard based merely on personal preference rather than a deep understanding of learning and teaching.



To make matters worse, oftentimes, teachers themselves are the most vocal critics of using education research to make thoughtful pedagogical decisions! That large numbers of teachers don't see the value of education research raises questions regarding what goes on in teacher education program. Perhaps as Berliner (1985) suggests, because teacher educators come from the ranks of teaching they:

“... see themselves as practical people, hired from or strongly identified with the world of practice. They believe in experience and apprenticeship as the major ways of learning to teach. This commitment has resulted in timidity about reading, critiquing, or using the scientific literature about teaching.” (p. 130)

Thus, both teacher education faculty and practicing teachers often promote an attitude that effective teaching is simply a matter of having a bag of tricks from which to choose.

Even when university based teacher education programs are well designed, coherent and taught by exceptional faculty, classroom-based field experiences can severely hinder a prospective teacher's development. When preservice teachers are placed with a cooperating teacher who does not model effective practices, they may find few opportunities to apply what they learned in their teacher education program and easily become disenchanted with and devalue that education (Penick & Bonnstetter, 1989; Berliner & Casanova, 1989). In attempting to fit in during their field experiences, pre-service teachers often question the relevance of their teacher preparation programs and may resort to mimicking their cooperating teacher's style of teaching. This is all the more likely if, as is often the case, what prospective teachers see their cooperating teacher doing is much the same as what they experienced as a student in their primary, secondary and post-secondary school experiences. The influence of observing common teaching practices six or more hours a day since the time



they began elementary school makes learning and adopting decision-making practices based on education research a difficult task.

In contrast, effective science teacher education programs link theory and the realities of practice (Penick & Yager, 1988). These programs are premised on the tenet that few individuals are “born teachers”. Therefore, preservice teachers must be well educated to understand teaching decision-making and practices that promote an optimal learning environment (Penick & Bonnsetter, 1989; Penick, 1988; Penick & Yager, 1988). Without effective teacher education, prospective teachers hold onto naïve perceptions of learning and teaching (Kagan, 1992).

Optimal programs focus on changing the thinking and actions of teachers. Research shows that science teacher preparation programs that focus on changing teachers’ classroom behaviors are largely successful at producing effective practicing teachers (Krajcik & Penick, 1989). These programs emphasize having well thought out goals for student learning, and thoughtfully and consistently implementing practices that promote those goals. The teachers that successfully complete these programs are pushed to develop and articulate a clear rationale for their goals, and practices that will promote them. Teachers with a rationale for their classroom decisions and behaviors have a consistent view of teaching and learning that takes into account students’ capabilities, desired student goals, teacher behaviors, and assessment (Penick, 1988; Penick, 2000). Teachers with a well developed rationale for teaching are more likely to be innovative throughout their careers (Penick & Yager, 1988). Accurate self-reflection is consistently promoted throughout these programs and preservice teachers are encouraged to continue that practice throughout their teaching careers.



When teacher education programs model the attitudes and behaviors consistent with effective teaching, their students more often adapt those behaviors into their own teaching practices (Stofflet & Stoddart, 1994; Penick & Yager, 1988). This is not surprising given that the behaviors students exhibit often reflect the behaviors of their teachers (Anderson and Brewer, 1946). Consequently, faculty in effective teacher education programs must model effective teaching practices, positive attitudes, and other attributes of exemplary teachers, and explicitly draw prospective teachers' attention to this modeling.

### **Current State of K-12 Science Education**

Like the quality of science teacher education programs, the current state of K-12 science education also varies widely. Unfortunately, the overarching picture is rather depressing. Abundant articles and reports (AAAS, 1989; Aldridge, 1989; APA, 1993; Goodlad, 1984; Penick and Yager, 1986; Staver and Small, 1990; United States Department of Health and Human Services, 1991; Yager, 1980; Yager and Penick, 1987) have for some time pointed to the inadequacies of U.S. science education. The consistent findings from studies of science teaching practices reveal a generally inadequate consideration of how people learn (Bransford *et al.*, 2000) and classroom practices that fail to engage children in meaningful learning (Schmidt, *et al.*, 1999; Weiss, *et al.*, 2003).

However, pockets of undeniable excellence have at times been found to exist in science education as illustrated by the *Focus on Excellence* monograph series (Bonnstetter, Penick & Yager, 1983; Penick, Yager, & Bonnstetter, 1986; Penick & Yager, 1983; Penick, 1983a, 1983b; Penick & Bonnstetter, 1983; Penick & Lunetta, 1984; Penick & Meinhard-Pellens, 1984) and work by Tobin and Fraser (1987, 1989, 1990). In creating profiles of



teachers in exemplary science programs, Penick *et al.* (1986) noted that those teachers identified as exemplary were far more aware of and attentive to a wide range of science education goals for their students. These teachers faced typical institutional and social constraints, yet maintained a more comprehensive vision of science education.

### **The Iowa State University Secondary Science Teacher Education Program**

#### *Requirements for Licensure*

Beginning in late summer of 1999, efforts began at ISU to develop a secondary science teacher education program that would consistently prepare high quality middle and high school science teachers. At that time, the secondary science teacher education component of the secondary licensure program at ISU was situated in the College of Liberal Arts and Sciences and consisted of several general education licensure courses offered in the Curriculum and Instruction department, one four-week science methods course offered in LAS, followed by twelve weeks of student teaching in a secondary science classroom. The wide-ranging restructuring of the ISU SSTEP was completed in 2000 and approved in 2001. Any student entering ISU during or after the fall 2001 semester who chose to earn a secondary science teaching license was required to complete the new ISU SSTEP program. Because freshman entering ISU during the fall 2001 semester would not begin their science education course work until after their sophomore year, the science education courses in the new program were first offered during the summer of 2003. Subjects involved in the study reported here completed the former ISU SSTEP, and only that program will be described here.



In the meantime, beginning in the spring 2000 semester, the four-week secondary science methods course was offered for the last time to four students completing their student teaching that semester. Students who would student teach at a later time, but who were not required to complete the newly approved science teacher education program, completed a semester-long science methods course during the spring 2000 semester. All ISU SSTEP students from spring 2000 through spring 2003 completed only one secondary science methods course. Figure 1 lists all the requirements for earning a secondary science teacher license during that time:

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Figure 1: Secondary science licensure requirements for students completing program from spring 2000 through spring 2002.

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Major in a science discipline (i.e. Biology, Chemistry, Geology, Physics)	
C I 280 Field Experience	(1-2 cr.)*
C I 333 Educational Psychology	(3 cr.)
C I 201 Introduction to Instructional Technology	(2 cr.)
C I 406 Multicultural Gender Fair Education	(3 cr.)
C I 426 Secondary Methods	(3 cr.)
C I 415 Senior Seminar	(Required)
SpED 250 Education of the Exceptional Learner	(3 cr.)
HPC 204 Social Foundations of American Education	(3 cr.)
LAS/CI 492 Secondary Science Methods	(3 cr.)
LAS 480 Field Experience - Science	(1-2 cr.)*
LAS/CI 417B, D or J Student Teaching	(12 cr.)

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\* 1 cr. = 20 clock hours of field experience. Minimum of 50 clock hours total are required prior to student teaching.

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*Secondary Science Methods (LAS/CI 492)*

At the core of the secondary science methods course (LAS/CI 492) is modeling and promoting the development of a research-based framework (RBF) for teaching science. Figure 2 provides a visual representation that summarizes the major components and relationships in an RBF. First generated by Clough and Berg in 1988 to help preservice

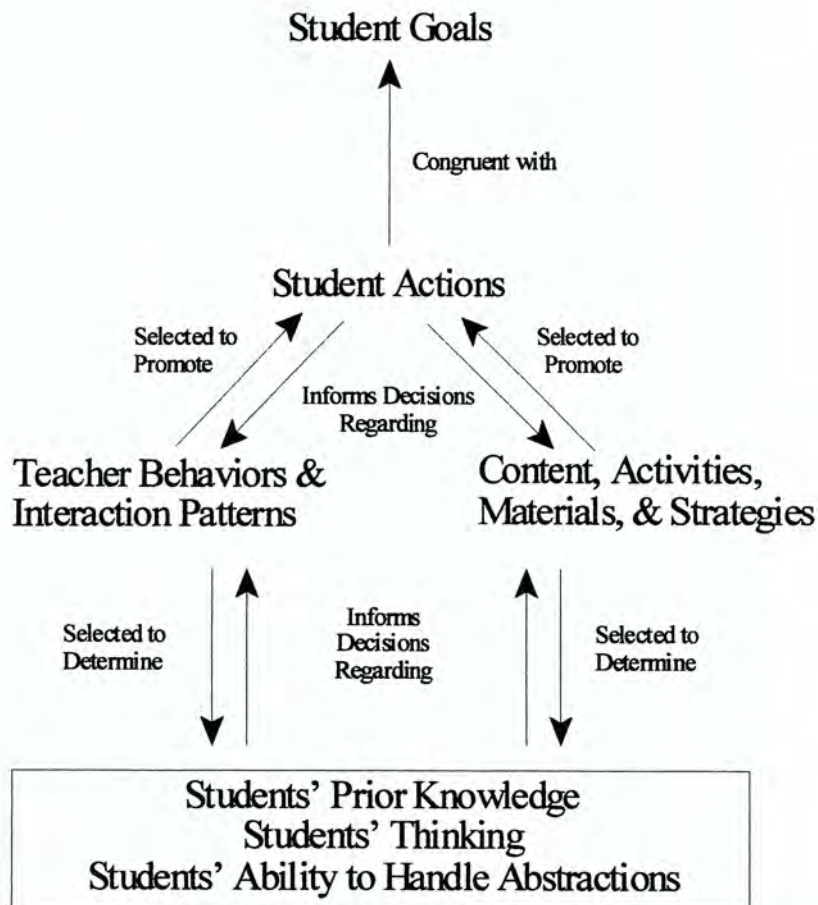


Figure 2. Components of a Research-Based Framework For Teaching Science



science teachers begin conceptualizing the complexities of teaching, the visual framework has since undergone several iterations (Clough, 1992; Clough & Berg, 1995; Clough & Kauffman, 1999). The visual framework in Figure 2 was used extensively in the semester length secondary science methods course (LAS/CI 492) to help students develop their own RBF. While the components in the visual framework certainly do not capture all that goes into learning and teaching, the schematic's purpose in the ISU SSTEP was to help students understand the complex nature of effective teaching, the many decisions that teachers knowingly or unknowingly make, and how these decisions coalesce to create the education experience. Clough (2003) writes "a research-based framework helps teachers to make sense of educational research in light of goals and how students learn, thus providing a more solid base for decision-making" (p.4). Moreover, an RBF, if taken seriously by teachers, serve as constant reminders of a desire for learning, teaching, and self-evaluation (Clough, 2003; Clough & Kauffman, 1999).

The visual framework and development of an RBF was the focus of LAS/CI 492. Students spent considerable time:

- Studying the current state of science education and reasons for persistent problems;
- Developing goals for student learning that are consistent with reform documents in science education (e.g. demonstrating deep understanding of fundamental science ideas, exhibiting creativity, applying science concepts, etc.);
- Developing student actions congruent with each goal;
- Exploring how people learn and the implications for teaching;



- Learning to select content, tasks and activities, and materials that reflect how students learn and promote desired goals;
- Implementing teacher behaviors and interaction patterns that reflect how students learn and promote desired goals;
- Developing detailed lesson plans that address all aspects of the visual framework;
- Learning how to accurately self-evaluate.

During the associated field experience, students were required to audiotape their classroom practice and turn in a thorough self-analysis addressing each aspect of the visual framework.

At the end of LAS/CI 492 students were required to write an RBF paper that thoroughly addressed each aspect of the schematic. RBF papers are typically 15 to 20 pages long, contain more than 30 references, and, in addition to addressing all the components in the visual framework, should include: why science should be taught; why the students has chosen to teach science; how the prospective teacher will provide evaluation of their program, students, and themselves; and a list of references in APA format. Students must justify what they will do and their rationale for what they describe. Research support should be extensive in the RBF paper, and should indicate the student has learned a great deal during the semester. Each student meets with the professor for 90 minutes to orally defend his or her research based framework for teaching science. The interview is viewed as an indicator of how well the students' innovative efforts are truly understood and will survive once they are in the teaching profession (Penick & Yager, 1988).

### *Science Content Requirement*

An understanding of both science content and effective science teaching practices are required to promote deep student learning. Tobin and Garnett (1988) examined two sets of science teachers, a set of two primary teachers and a set of two secondary teachers. These teachers were known to have exemplary pedagogical practices in their science classrooms. Even though these teachers were nominated because they were seen as having expertise in science pedagogy, Tobin and Garnett found an interesting contrast between the two sets of teachers. They found all four teachers had adequate pedagogical knowledge but the primary teachers lacked the content knowledge that was necessary to promote desired student learning. Asking effective questions and effectively responding to students' thinking to understand and disentangle their misconceptions requires that teachers possess a deep understanding of their content, how students learn, and effective pedagogy. Windschitl (2002) noted that "insufficient knowledge of the subject matter can lead to misconceptions by both the teacher and the students" (p. 148), Teachers who do not deeply understand their discipline present concepts that are not connected to one another resulting in students that are disillusioned with science. Thus, the ISU SSTEP requires all students to have earned a bachelors degree in a science content area before being recommended for licensure.



### **Chapter 3. Study Participants and Data Gathered**

#### **Study Context and Questions Addressed**

The work completed and reported here is a very small portion of much larger study by Iowa State University science education faculty and graduate students to determine the effectiveness of the former (2000-2003) and significantly restructured (2003-2006) ISU SSTEP. The intent of the large comprehensive study is to compare and contrast graduates of the former and new programs, and determine what the current ISU SSTEP does well and what it doesn't do so well, and how it can be improved. The study does not attempt to evaluate nor make judgments on the effectiveness of any individual subject's science teaching practice. The work reported here collected data relevant to the following three questions, but only from subjects that successfully completed the former ISU SSTEP between spring 2000 and spring 2002:

1. What is the retention rate of these ISU SSTEP graduates and how does that compare to national retention rates?
2. For these ISU SSTEP graduates who never taught or are no longer teaching, what was their reason for leaving the profession?
3. How do these ISU SSTEP graduates assess the general education and science education components of their teacher education program?

#### **Methodology**

The subjects in this study were individuals who had successfully completed the ISU SSTEP from the spring 2000 semester through the spring 2002 semester and then graduated from ISU with a science teaching endorsement. All but four of the targeted subjects

completed the semester length version of LAS/CI 492. The four exceptions completed a four-week length version of LAS/CI 492 prior to student teaching the same semester. These four individuals were included because the course structure and objectives, while delivered in an accelerated fashion, was the same as the semester-length course. An attempt was made to contact all fifty-six individuals who successfully completed the ISU SSTEP from the spring 2000 semester through the spring 2002 semester and then graduated from ISU with a science teaching endorsement. Those individuals whose contact information could be ascertained were sent a letter explaining the study, a consent form asking them to participate in the study, a questionnaire, and a postage-paid self-addressed envelope. A second mailing was sent to those who did not respond to the first mailing. See Appendix A for a copy of the letter and consent form.

The four-page questionnaire was divided into four sections. The first section requested general demographic information (e.g. age, graduation date) and whether or not the respondent was currently teaching. Those currently teaching were directed to section two of the questionnaire where they were asked to report what subjects and grade levels they were teaching, other schools they may have taught, reasons for moving to another school, and how long they expected to continue teaching. Those who were not currently teaching were directed to section three of the questionnaire that asked them to explain why they left the teaching profession, or, if applicable, why they chose not to enter the profession. Section four of the questionnaire asked subjects to respond to a variety of question regarding their impressions of the ISU teacher education program. Please see Appendix B for a copy of the questionnaire.



Subjects' responses to the questionnaire provided information to determine the teacher retention rate for those who successfully completed the ISU SSTEP from spring 2000 through spring 2002. This self-report data was compared to teacher retention rate reported in the National Science Teacher Association Report (2003). Reasons given for never entering/leaving the teaching profession can also be compared to national data. Finally, respondents' reflections regarding the utility of the ISU SSTEP provides potentially useful information for improving the program.

Because efforts were made to include in this study all former students who completed the ISU SSTEP from spring 2000-2002, the researcher is a participant. To reduce any bias in the way the researcher responded to questions in the survey, she completed her own questionnaire prior to viewing any participants' data.

### **Limitations of the Study**

Several limitations exist that prevent drawing broadly generalized conclusions from the work reported here. First, the subjects thus far contacted are just the beginning of an effort to gather data from all seventy-seven individuals who have completed the former ISU SSTEP that ended in December 2002. The data collected thus far cannot be said to be a representative sample of all those who have completed the former ISU SSTEP. Second, teachers agreeing to participate in this or any study may very well be more active in education, more interested in teaching, and more interested in improving their practice. Thus, the study participants may very well not be a representative group of the larger sample. Third, while the questionnaire addressed ISU SSTEP graduates' perceptions of the general education and science education components of their teacher education program, subjects'

written responses to the questionnaire must be followed with interviews that will be completed by other researchers in the future. Finally, the most important assessment of the ISU SSTEP will be the pedagogical decisions and practices its former graduates exhibit. The work reported here did not collect any data on subjects' pedagogical decision-making and practices, but that will be part of the larger comprehensive study that is currently underway. The data collected and reported in this small study is merely descriptive with no attempt to provide definitive answers to the three research questions. However, the data collected is relevant to the much larger comprehensive study that will be completed in the future by ISU science education faculty and graduate students.



## **Chapter 4. Results**

Nationally, thirty percent of teachers leave the profession within three years of starting to teach and fifty percent leave within five years. Lack of respect for the profession (LaTurner, 2002), salaries (Darling-Hammond, 2000; Goodlad, 1984), and poor teacher preparation (Peske et al., 2001; LaTurner, 2002; Darling-Hammond, 2000) are suggestions for these current numbers. This study collected data from subjects who completed the ISU SSTEP from spring 2000 through spring 2002 to determine their retention rate. Explanations were sought for why particular subjects never taught or left the teaching profession. Finally, former ISU SSTEP graduates' comments were reviewed to establish how they assess the general education and science education components of their teacher education program.

### **Retention Rate of ISU SSTEP**

Of the 56 individuals who completed the ISU SSTEP from spring 2000 through spring 2002, 44 were located. Twenty-three of these individuals sent back complete questionnaires. The remaining 21 individuals were located through personal contacts, email, and the Internet. Thirty individuals who completed the ISU SSTEP program from spring 2000 through spring 2002 continue to teach, six began teaching and then left the profession, eight never entered the teaching profession, and eleven participants could not be located. Thus, of those ISU SSTEP students who completed the program from spring 2000 through spring 2002 and who can be located, 82% of them entered the teaching profession (Table 1). The timing of the data collection permits only the determination of the ISU SSTEP three-year retention rate. Of the twenty-one individuals responding who earned their science teaching license three or more years ago, six (28.6%) have left the teaching profession.

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Table 1: ISU SSTEP students completing the program from spring 2000 through spring 2002

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Total of questionnaires sent out	56
Former students located	44
Currently teaching	30
Taught, but then left the profession	6
Never taught	8

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### **Why Former Graduates of ISU SSTEP Choose Not to Teach**

Of the former ISU SSTEP students who are not teaching, eight never taught while six entered and then left the profession after teaching for some time. Data collected from the questionnaires and through personal contacts showed that four of the eight individuals who never entered the teaching profession were offered and accepted what they felt were more desirable positions. One became a youth pastor for a church, another became a missionary in Turkey, a third accepted a research position that offered far more money, and the fourth accepted a position as an educational coordinator at a zoo. The remaining four former students did not provide reasons as to why they did not enter the teaching profession.

Six former ISU SSTEP students entered the teaching profession and later left. Of these six individuals, four of them completed the four-week secondary science methods course (LAS/CI 492) during the spring 2000 semester. One of the six students accepted a full-time substitute position for six weeks, but then returned to ISU to earn a master's degree in education. The remaining individual who left the classroom also returned to earn a masters degree in education. Three out of these six individuals who left teaching claimed that the



time required for teaching and poor teaching salaries were their reasons for pursuing other professions. Another said she left for personal reasons.

### **Former ISU SSTEP Graduates' Perceptions of the Program**

When the questionnaires came back from the former graduates, many of the comments made concerning the overall effectiveness of ISU SSTEP were not surprising. Only two of the former students claim that the program gave them great experiences. The remaining students felt there were only certain classes or experiences that had helped them, and that there was room for improvement.

The general education classes required of all education licensure students at Iowa State University were claimed to be the least valuable to these former students. Nineteen graduates made comments stating that the general education classes did not help them prepare for the classroom. These comments ranged from the classes being a waste of time to being filled with insignificant content. Two students felt that the teaching format used by the general education classes was the exact format that they were taught not to teach in. One graduate said that "literally I did not take anything away from general courses," while another graduate thought the general education courses were geared more towards elementary education students.

Twelve of the 23 former students stated that secondary science methods course, LAS/CI 492, was the class that helped them the most in preparing them for what teaching would actually be like. One graduate stated that the "actual program did not began until the semester before I was scheduled to do my student teaching." LAS/CI 492 is typically completed the semester before student teaching. CI 426/415, a general methods course for



secondary education majors that also addresses policies and laws in schools was mentioned by two other students as helping them prepare for teaching. The only other class that was mentioned positively by two graduates was CI 201, a technology class that is required by every education major.

Graduates who completed the ISU SSTEP program from spring 2000 through spring 2002 were required to complete 50 hours of field experience in a secondary classroom. Nine graduates indicated they would have benefited from more experiences in the classroom. They felt that the field-based experiences they had during the program were where they learned the most about teaching. As one graduate stated, “At this point in my career, I feel being in the classroom (for practicums) has been the most influential in my being an effective teacher.”

Other graduates stated they felt student teaching was the most helpful part of their teacher preparation. A few of these graduates credited this to their cooperating teachers. In all, about half of the students said that either more experiences in the classroom and more methods courses would have better prepared them for the teaching profession. Extending these opportunities may address comments such as the program as a whole providing “little about how to survive the first year and specifics about what to teach” and “prepared me for nothing of what teaching would be like”.

### **The Value of Secondary Science Methods: LAS/CI 492**

The secondary science methods course, LAS/CI 492 was given considerable credit in preparing teachers to understand how students learn, developing their ability to evaluate their teaching behaviors and student progress, incorporating educational research into their practice, and how to effectively teach science. Seventy percent of the graduates claim to use



some of the methods that they learned in their classrooms. Two graduates say that LAS/CI 492 gave them confidence in their teaching abilities and another graduate believes that he is better prepared than other teachers from different programs, for which they are very thankful. Five graduates are also in agreement that LAS/CI 492 was the best class they took in preparing them for teaching, particularly science. One of these teachers said of all the courses, “it was most productive” and another teacher says that LAS/CI 492 was the “most valuable course taken.”

Two graduates in preparing them to become effective teachers mentioned self-evaluation. This group of graduates expressed the importance of honest reflection on their current teaching behaviors and the lessons that they incorporate into their classroom. A graduate said that the self-evaluation skills he learned in LAS/CI 492 helped him to monitor his progress in becoming an effective teacher. Another graduate said it helps her to reflect on lessons as she is doing the lesson in order to improve it before the next period.

Two graduates alluded to the idea of LAS/CI 492 helping them know what they wanted to do in their classrooms and how to get there. One graduate said that LAS/CI 492 made her look deep down into determining her values as an educator and what ways to impact her students. The other graduate said the student goals generated in LAS/CI 492 gave her focus as to what she does and does not teach in her classroom.

Two graduates gave credit to the instructor for providing them with confidence in their teaching abilities. Another graduate felt that the enthusiasm and compassion of the instructor was an added bonus to LAS/CI 492. This made her feel that he cared about helping mold her into the best future science teacher possible.



Four individuals in this study were part of the four week methods course. Two of those four stated that four weeks were not enough for a methods course. One said that she learned valuable things, but once she entered the classroom it was a “free for all”, and did what she needed to do to survive. She admits that a longer methods course and a practicum before she student taught would have been much more effective. This graduate has left the teaching profession. The other graduate from the four-week course said that she tried to fit the constructivist learning theory into the classroom and knew that it was better than the behaviorist learning theory but didn’t properly understand how to support the open-ended activities. Indicating that she had a hard time implementing what she knew to be the more effective learning theory. This teacher also decided to leave the teaching profession to pursue a master’s degree in education because she felt she needed to learn more about teaching.

Only two negative comments were made about LAS/CI 492. One individual, who also has an elementary education degree, thought that she relied more on her elementary education courses for daily classroom routines. She felt that she did not apply what was taught in LAS/CI 492 as much as she wanted because of the daily stresses of preparation, grading, and interaction with the students. This teacher left the teaching profession after one year of teaching. The other negative comment was from an individual who thought her field experience was not very helpful. She thought the teacher she was with did not use research-based practices that were being taught LAS/CI 492 and therefore it was difficult to understand how research-based practices were used in the classroom.



### **The Value of a Research-Based Framework to Teachers**

Developing research-based framework (RBF) is an arduous task, but one that many participants in the study found valuable. As one graduate puts it, “the RBF is key” to their teaching, “even though it was *extremely* painful to put together.” Another graduate says the RBF is “critical in becoming the most effective teacher you can be.” Two graduates claim they don’t know where their teaching would be without putting together a framework for their teaching. One teacher talked about the research-based framework providing her with the capabilities to teach without a book for her entire first year.

Twenty-one of the 23 (91.3%) graduates claim that they still think of their research-based framework and believe that it still has value to their teaching. One graduate said, “the RBF serves as a constant reminder.” Another graduate claims she still looks at the articles that she used to write her research-based framework and even uses some of the articles to start the school year. Other things that graduates felt the RBF helped them understand was their students, determining desired outcomes for the students, and curriculum decisions.

Four graduates claimed that they still used their student goals that they wrote in their RBFs for a variety of things. One graduate uses her student goals to write grants, teach upper level courses, and teach classroom teachers. Teachers refer to these goals as giving them guidance in how to improve their teaching in order to get their students to reach the goals they have set for them. As one teacher said, “The RBF solidified my interpretation of classroom goals and the way to get there. Thus I have a clearer picture of where I want to take my classroom.” Another teacher says that the RBF has given her focus to what she teaches in the classroom.



Although the majority of the comments about the research-based framework were positive there was one concern that appeared among four of the former ISU SSTEP students. These individuals talked about how it was easy to write about the “ideal” classroom in their RBF before they entered the teaching profession but found it difficult in making the “ideal” classroom a reality. One of the individuals said that the research-based framework was only somewhat valuable stating, “I felt that I went into the classroom with this idealized picture which just didn’t turn out to be true.” This same person claims that she still reflects upon the RBF when she teaches but feels that her goals have changed since she has been in the “real” world. Two of the other individuals who shared similar feelings completed the four week methods class during the spring 2000 semester. These teachers give the impression in their comments that they gave up at trying to implement what they had learned from writing their research-based framework into their practice. The fourth teacher who made a similar comment as the other three appears to not to have given up and is still working on trying to implement the research-based framework and understands that a teacher “needs an RBF to make sure students are learning and meeting goals.” It would be interesting to look into this further to see what makes teachers feel that they have a hard time putting into practice what they learned while writing their RBF and what could help them make their “ideal” classroom become a reality.

Out of all the graduates, only two said that they haven’t thought about their research-based frameworks. One stated that she had not looked at her research-based framework since her student teaching. The other graduate says that the RBF has not had really any value on her teaching science since she has started teaching.



### **How Long Teachers Plan to Continue to Teach**

All of teachers who were currently teaching were asked how long they planned to continue in the profession. Five individuals, ranging from just entering their first year of teaching to being in their third year, did not respond. Three teachers having one to three years experience responded that they would teach anywhere from another seven to fifteen years. Another teacher was not sure how long she would continue teaching, but speculated at least five more years. Five teachers who had been teaching one to two years claimed that they will teach until retirement. One stated that they “enjoy being an educator” but would “maybe change subject or grade,” while another teacher stated that they “really enjoyed their first year of teaching.” Another two teachers said that they would teach 20 to 30 years. One teacher who has an informal teaching position states that she really likes her job and plans on being at her current position for awhile.

It was interesting that one teacher, who had been teaching for two years, had a revelation for how long she thought she would teach for after she filled out the questionnaire. She wrote that she would teach at least five years then wrote the following comment under the question:

“This was my answer before I answered this survey. After I completed the survey I was so excited about teaching again. I love it!!! I think I could teach forever. Then I think about the politics and parents that go with it – this does not make me want to teach forever. Definitely a give and take! Stressful, yet so fulfilling.”

### **Assignments/Experiences That Were Helpful to Former Students**

In the questionnaire graduates were asked what assignments/experiences during the ISU SSTEP helped them learn to teach effectively. Many things were listed among the

former students, but student teaching, writing the research-based framework, and classes LAS/CI 492 and CI 426/415 were the most commonly listed as being helpful in teaching them how to become effective teachers. Being in the classroom, having observation time, and practicums were also frequently mentioned among the teachers. Three teachers who had taken graduate level education courses mentioned these courses as helpful. Another three teachers talked about designing lesson plans to fit their student goals and creating units that were based on inquiry and the nature of science as being helpful. Other individuals mentioned coding their questioning/teaching behaviors, wait-time, how to ask effective questions, and the oral defense as being helpful in helping them teach effectively.

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Table 2: Assignments/experiences 23 ISU SSTEP graduates stated being helpful in preparing them for teaching.

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RBF	11	47.8%
Student teaching	10	43.5%
Observations/experiences	9	39.1%
LAS/CI 492	7	30.4%
CI 492/415	7	30.4%
Developing lesson plans	5	21.7%
Teaching behaviors	3	13%
Graduate classes	3	13%
Oral defense	1	4.3%

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### **Ideas for Improvement and Additional Comments for ISU SSTEP**

At the end of the questionnaire graduates were asked to share any additional information about their experience with the ISU SSTEP, including how they thought the program could be improved. The most popular suggestion among these graduates was more



time needed in the classroom to help improve classroom management and lesson plans. One graduate believed providing safe and structured experiences would help potential science teachers with the complexities they would face once they entered the teaching profession.

Three graduates believe the general education courses are a waste of time. One graduate suggested getting rid of the general curriculum and instruction classes and developing classes that are more interactive. Another graduate came up with a very creative idea of redesigning the whole entire program. The program would have science faculty teach the science classes in a way that reflected what he had learned in LAS/CI 492 instead of the lecture format that many science professors use when they teach science courses. This particular graduate felt that his biology courses he had were “very poor, and did very little but discouraged me from teaching science.” This former student though was realistic in admitting that it is probably not possible for this to happen because it would take a major change in personnel.

Another suggestion by two of the graduates was to increase the number of semesters of methods from one semester to three semesters. The remaining suggestions from graduates included: providing classes in differentiating assessments/course work for the different learning levels of students, classes on educational politics, classes aligned with the National and Iowa teaching standards, non classroom responsibilities, and current teachers in the profession suggesting what should be taught to potential teachers.

## **Chapter 5. Discussion and Need for Further Research**

The information that was collected and examined for this study is a very small part of a larger study to determine the effectiveness of the ISU SSTEP. The intent of the large comprehensive study is to compare and contrast graduates of the former and new ISU secondary science teacher education programs, and determine what the new ISU SSTEP does well and what it doesn't do so well, and how it can be improved. The work reported here collected data relevant to the following three questions, but only from subjects that successfully completed the former ISU SSTEP between spring 2000 and spring 2002:

1. What is the retention rate of ISU SSTEP graduates and how does it compare to national retention rates?
2. For the ISU SSTEP graduates who never taught or are no longer teaching, what was their reason for leaving the profession?
3. How do the ISU SSTEP graduates assess the general education and science education components of their teacher education program?

Overall, the retention rates of the ISU SSTEP graduates were similar to the national retention rates. Reasons why ISU SSTEP graduates never entered the teaching profession or reasons why they left the teaching profession were similar to those of the national data reported in chapter 2. Finally, ISU SSTEP graduates had negative things to say about the general education they received but had very positive things to say about the science education components.



### **Retention Rates for ISU SSTEP Graduates**

According to the National Commission on Teaching and America's Future (2003) the current rate for teachers leaving within in their first three years of the teaching profession is 30%. This study found that 28.6% of ISU SSTEP graduates leave within the first three years of teaching which differs little from the national average. However, when the four students who completed the four-week secondary science methods course are separated from those who completed the semester length science methods course, the retention rates are zero out of four (0%) and fifteen out of seventeen (88.2%). This shows that the length of the science methods course may have an effect on how long graduates chose to remain in the teaching profession. Perhaps students completing the semester-length secondary science methods course had more time to reflect on truly understand what they were being taught about effective science teaching.

### **Reasons Why Graduates Never Taught or Left the Teaching Profession**

Money and the amount of time demanded on new teachers were two reasons mentioned in chapter 2 as why graduates never enter the teaching profession. This holds true for the majority ISU SSTEP graduates that never entered or have left the teaching profession. One graduate stated that he did not enter the teaching profession because he was offered a research position in a company that paid a lot more than teaching.

Four of the six graduates that left the teaching profession listed the amount of time required for teaching being a reason for wanting to pursue a different occupation. One former teacher said, "Quite honestly I wanted a life outside of teaching. I wanted to see my

family...” Another claimed “the day to day energy needed to prep two lab courses was draining” and found teaching “difficult to adequately teach the range of students in my classroom.” Research is further needed to see what additional factors contribute to why these teachers feel that the teaching profession is too time consuming. Building units, developing inquiry-based labs, classroom management, parent, the number of students in a classroom, and unrealistic workload could be some possibilities for their reasoning.

The remaining two teachers left the teaching profession to pursue master’s degrees in education. One of these teachers expressed the feeling that she wanted to get her master’s degree because she felt there was still much more she needed to learn in becoming an effective science teacher. Whether or not the other teacher pursued his master degree for the same reason is not known. It would be interesting to see if any of the other graduates of the ISU SSTEP are interested in pursuing a master’s degree and what their reasons would be for pursuing the degree. One reason could be that they also believe there is more to know effective teaching. Two possible reasons could be that they simply want to move up on the pay scale or they have decided to go into administration.

### **Assessment of the General Education Components of ISU SSTEP**

ISU SSTEP general education courses took the hardest criticism from graduates. Many of the graduates thought the classes were a waste of time. One graduate is not sure if she even uses anything from the general education classes. As she said in reference to the general education classes, “All of the other stuff is out the window for me personally...or else I use it and don’t realize it.”



Former graduates talked about the teaching practices used in the general education classes. Too often lecture with little interaction is used requiring very little thinking by students. As one graduate said, “Most of the classes were taught in the exact format we were taught not to teach in.” Another graduate said that, “The other classes in the teacher preparation program (were) extremely easy and not filled with significant content.” The general education courses required by the ISU SSTEP should consider further scrutiny as to their effectiveness in student preparation and how they could be improved to reflect effective teaching.

#### **Assessment of the Science Education Components of ISU SSTEP**

LAS/CI 492 was ranked the highest class among graduates for the class that helped them the most to prepare for teaching. One teacher said that LAS/CI 492 was “very effective in helping understand teaching.” The various components that the classes teaches such as self-evaluation, how to use research studies, wait-time I and II, and questioning were just a few of the many things that were mentioned as helping graduates prepare for teaching. It is obvious that LAS/CI 492 offers many valuable topics that graduates believe are useful to them in the classroom.

One of the factors that make LAS/CI 492 different from other education classes is the instructor. Two students commented how the instructor helped them gain confidence in their teaching skills, while another graduate commented on the instructor’s passion for wanting teachers to become their best. One other student mentioned an instructor from CI 426/415

### **The RBF's role in ISU SSTEP**

Many graduates spoke of the influence of having to develop a research-based framework on their current practices. One of the best ways to show how the RBF still influences graduates, is by a comment written by a graduate explaining how the RBF has affected their practice,

“The RBF is what helped me make the connections necessary to understand the importance of student goals, how to recognize and promote student goals, learning theories, nature of science, and effective teaching through deliberate teacher behaviors and selection of classroom materials and activities.”

Although these graduates indicate that they still use what they wrote in their RBFs, the comprehensive study of which that reported here is a part will evaluate how well graduates implement what they wrote in their RBFs into their classrooms.

Three graduates indicated that they had problems making their “ideal” classroom become reality for them in their classroom. These teachers also give the impression that they gave up at trying to implement what they had learned from writing their research-based framework into their practice. This needs to be further investigated to determine the reason why these graduates feel it was difficult to make their “ideal” classroom a reality.

### **Room for Improvement**

Subjects in this study made many comments indicating improvements should be made in the overall ISU SSTEP. Increasing the number of observations or practicums was the most popular suggestion (61.5%) ISU SSTEP graduates wanted to see in the program. Graduates believed that more observations/practicums would help with the complexities that they would face once they entered the teaching profession. A small number of graduates



mentioned that they did not feel prepared for their first year of teaching. Perhaps more observations/practicums could help graduates feel better prepared for their first year of teaching. Some graduates also felt additional courses like LAS/CI 492 would better prepared them to teach science. Finally, the need to improve the content and delivery in general education courses was common.

Teaching is a complex undertaking. Teachers may have unrealistic expectations that teacher preparation programs should prepare them to address every teaching related issue they will face in and outside the classroom. In this study, two graduates felt that they were not prepared for all of the complexities of teaching during their first year. If graduates don't feel that their basic needs are being met, they may reject the program and copy cooperative teachers' practices and behaviors, thus perpetuating the status quo. However, teaching is too complex for all issues and possible happenings to be addressed in detail apriori. Thus, comments by subjects in the study must be taken seriously, but placed in context of the complex realities of the teaching profession.

Penick and Bonnstetter (1989) and Berliner and Casanova (1989) have found that when preservice teachers are placed with a cooperating teacher who does not model effective practices, they may find few opportunities to apply what they learned in their teacher education program and easily become disenchanted with and devalue that education. One graduate did state that they had a hard time with the teacher that they were paired up with during her field experience. The graduate stated that she could not see any of the research practices be used by her cooperating teacher, therefore making it hard for her to understand how to use the research based practices.



Goodlad, Soder, & Sirotnik (1990) also discussed how many teacher education programs can simply be a series of courses with little coherences, therefore leaving prospective teachers with the decisions of what makes sense and what doesn't. Ten former graduates talked about the general education classes having little influence to their teaching and sixteen claim to use some of the methods that they learned in their classrooms. Whether or not these graduates do or do not use concepts from their general education courses or from their science methods course LAS/CI 492 cannot be actually determined until their teaching behaviors and practices have been observed.

Chapter two discussed reasons why teacher chose to leave the teaching profession. Graduates said that they left the teaching profession because of salaries and the amount of time that was required. Darling-Hammond (2000) noted that salaries as a reason for teaching leaving the teaching profession, while LaTurner reported the time demanded of new teachers as another reason.

Chapter two also discussed the importance of effective teaching preparation programs changing the thinking and actions of teachers (Krajick & Penick, 1989). These comments show the possibilities that some graduates might not have developed the decision-making and practices that promote an optimal learning environment and believe that a teacher education program should prepare them for all the complexities that they will face. Trying to teach prospective teachers about all of the complexities that they could possibly face in teaching would be impossible and that is why effective teaching programs try to instill graduates will decision-making and practices that promote optimal learning.



## **Future Research**

Many criticisms and suggestions by subjects in this study have been addressed in the new ISU SSTEP that began in the summer of 2003. This new program requires a series of three science methods courses for undergraduates (four for graduate licensure students) each with an associated field experience. The minimum number of hours students spend in secondary school classrooms prior to student teaching has been doubled from 50 to 100. And students in the new ISU SSTEP must complete a course addressing the nature of science and its relevance to science education. Finally, a Biology Education Learning And Teaching (BETAL) learning community is now in place and many secondary science education students from all disciplines take part in it. Research is now being conducted to evaluate this new program and compare it to the former program in an effort to further improve the preparation of secondary science teachers at Iowa State University.

## Appendix A. Letter and Informed Consent Form to Participants

April 21, 2003

Dear [study participant],

I hope this letter finds you well. I am writing in hopes that you will be willing to help us as we work to improve the secondary science teacher education program at Iowa State University. Much about the structure of the preservice science education program will change this coming fall. Instead of one science methods class, all prospective teachers will take a series of three science methods courses, each with an accompanying field experience. All of these methods courses and field experiences, plus a "Nature of Science and Science Education" course will be completed prior to student teaching. As a past graduate, we value your feedback regarding your experience in the program you completed and we will use what you provide in shaping the content of the courses in the new program.

If you are willing to help us, here is what we will ask from you:

- First, please read the next three pages carefully as they address your informed consent for this research study. If you agree to help us, on page three of the INFORMED CONSENT DOCUMENT under "Participant Signature" please print and sign your name, and place the date on the form. You should keep the first two pages of the form and only return the third page in the self-addressed stamped envelope.
- Second, please fill out the questionnaire that we have included and return that with your signed consent form. However, if you would rather fill out the form on your computer, please let us know and send us your e-mail address. We will send you a MS Word attachment that you can complete, save, and then return as an attachment.
- Third, after we receive your questionnaire, we may contact you asking if we can conduct a short follow-up interview to seek clarification and additional information regarding your completed questionnaire. You may decline this request, and only in the event of a follow-up interview would any audio materials be generated in this study.
- Finally, for those participants who are willing, we would like to visit some of my former students' classrooms to observe interactions between them and their students. We do not have the resources to visit all former students' schools, nor do we expect that everyone would wish us to, but we will inquire regarding your interest. While some visits could take place yet this school year (with your permission), others will likely have to wait until next fall.

We do hope you will choose to participate in this study and share with us your perspectives (both positive and negative) regarding the program you completed. I enjoyed working with you and look forward to hearing your perspectives on our program and how it can be improved.

Sincerely,

Michael Clough  
Assistant Professor  
mclough@iastate.edu



## INFORMED CONSENT DOCUMENT

**Title of Study:** Baseline Study of Program Effectiveness: Teacher Retention Rate and RBF Implementation

**Investigators:** Michael P. Clough, Ph.D  
Joanne K. Olson, Ph.D.  
Kristen Campbell, M.S. student  
Joseph Taylor, M.S. student  
Crystal Bruxvoort, Ph.D. student

This is a research study. Please take your time in deciding if you would like to participate. Please feel free to ask questions at any time.

### INTRODUCTION

The purpose of this study is to seek information from all former students who took CI/LAS 492 "Secondary Science Methods" at Iowa State University from the spring of 2000 through the fall of 2002 in order to improve science teacher preparation programs and the preparation of science teachers at ISU and other institutions. You are being invited to participate in this study because you have completed CI/LAS 492 and graduated from ISU with a licensure to teach secondary science.

### DESCRIPTION OF PROCEDURES

If you agree to participate in this study, we will ask you to do the following: (1) Fill out a questionnaire that will be sent via e-mail (or, if you prefer, by U.S. mail) to acquire information regarding your teaching status and your impressions of the ISU secondary science teacher education program; (2) Take part in an interview seeking clarification and additional information regarding your answers to the questionnaire responses (with your permission, these interviews will be audiotaped and transcribed for research purpose; and (3) Visit as many your classes as you will permit to observe classroom interactions. If you do not wish to be audiotaped or permit classroom observations, we still would like you to fill out the questionnaire and return it.

Any audiotape will be heard only by ISU individuals directly involved in this project and will be erased or returned (your choice) at the completion of this project. Your name, school name, location, or any other identifiers of you will not be used in any potential publication or other dissemination. Finally, you will have full access to all of your data, and other teachers involved in the project will have access to the data of the group as a whole (with no names included).

### RISKS

No risks are anticipated for participating in this study, and you are free to withdraw your participation at any time without risk or penalty.

**BENEFITS**

No personal benefits may occur for participating in this study. However, future humankind may benefit from this study by improving science teacher preparation programs and the preparation of science teachers.

**COMPENSATION**

Subjects will not be compensated for their time and/or inconvenience participating in this research.

**PARTICIPANT RIGHTS**

Your participation in this study is completely voluntary and you may refuse to participate or leave the study at any time. If you decide to not participate in the study or leave the study early, it will not result in any penalty or loss of benefits to which you are otherwise entitled.

**CONFIDENTIALITY**

Records identifying participants will be kept confidential to the extent permitted by applicable laws and regulations and will not be made publicly available. However, federal government regulatory agencies, the U.S. Department of Education and the Institutional Review Board (a committee that reviews and approves human subject research studies) may inspect and/or copy your records for quality assurance and data analysis. These records may contain private information.

To ensure confidentiality to the extent permitted by law, the following measures will be taken: all names will be kept confidential. Names on questionnaires will be removed when received and replaced with codes. The only persons having access to the records will be those listed at the top of this form and undergraduate research assistants who are under the direct supervision of Drs. Clough and Olson and have completed university human subjects research training. All audiotape, questionnaires, and other records will be erased or destroyed at the completion of the project subject to university regulations. If the results are published, your identity will remain confidential.

**QUESTIONS OR PROBLEMS**

You are encouraged to ask questions at any time during this study. For further information about the study contact Dr. Michael Clough at (515) 294-1430, [mclough@iastate.edu](mailto:mclough@iastate.edu) or Dr. Joanne Olson at (515) 294-3315, [jkolson@iastate.edu](mailto:jkolson@iastate.edu). If you have any questions about the rights of research subjects or research-related injury, please contact the Human Subjects Research Office, 2810 Beardshear Hall, (515) 294-4566; [meldrem@iastate.edu](mailto:meldrem@iastate.edu) or the Research Compliance Officer, Office of Research Compliance, 2810 Beardshear Hall, (515) 294-3115; [dament@iastate.edu](mailto:dament@iastate.edu)



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**PARTICIPANT SIGNATURE**

Your signature indicates that you voluntarily agree to participate in this study, that the study has been explained to you, that you have been given the time to read the document and that your questions have been satisfactorily answered. You will receive a copy of the signed and dated written informed consent prior to your participation in the study.

Participant's Name (printed) \_\_\_\_\_

\_\_\_\_\_  
(Participant's Signature)

\_\_\_\_\_  
(Date)

**INVESTIGATOR STATEMENT**

I certify that the participant has been given adequate time to read and learn about the study and all of their questions have been answered. It is my opinion that the participant understands the purpose, risks, benefits and the procedures that will be followed in this study and has voluntarily agreed to participate.

\_\_\_\_\_  
(Signature of Person Obtaining  
Informed Consent)

\_\_\_\_\_  
(Date)

## Appendix B. ISU Science Teacher Education Graduate Questionnaire

### Section 1: General Information

Name: \_\_\_\_\_

E-mail: \_\_\_\_\_

Your name will be removed (survey will be cut at the dotted line) and replaced with a code when the questionnaire is received.

Code (For Office Use Only): \_\_\_\_\_

Age: \_\_\_\_\_ ISU Graduation Date: \_\_\_\_ / \_\_\_\_ / \_\_\_\_

Are you now teaching? (please circle):      Yes      No

*If "yes," please go to section 2  
If "no," please go to section 3.*

### **Section 2: If you are currently teaching (Please use back of sheet if you need more space)**

Subjects and grade level that you currently teach or have taught (e.g. biology-grade 10, chemistry-grade 11-12, etc.):

When did you begin teaching at this school? \_\_\_\_\_

At how many other schools have you taught? \_\_\_\_\_

If you have taught at other schools, please indicate how long you were there and your reason for moving.

How long do you believe you will continue teaching? \_\_\_\_\_

*Please go to section 4*



**Section 3: If you are NOT currently teaching (Please use back of sheet if you need more space)**

How long did you teach (enter "zero" if you never taught): \_\_\_\_\_

If you did teach, what subjects and grade levels did you teach (e.g. biology-grade 10, chemistry-grade 11-12, etc.):

What were your reasons for leaving the teaching profession/never teaching?

*Please go to section 4*

**Section 4: Feedback regarding the ISU teacher education program (Please use back of sheet if you need more space)**

How well do you feel the *secondary science methods course* (CI/LAS 492) prepared you to teach science? Of what value, if any, has the research-based framework (RBF) you developed in CI/LAS 492 been to you in teaching science?

In your RBF you listed student goals for science education that you felt were important at *that* time. What now are your goals for science students? Please rank these from most to least important. Then place a star next to those goals you feel you most emphasize in your teaching.

How well do you feel the secondary teacher education program *as a whole* (this includes all your education courses) prepared you to teach?

What assignments/experiences that you completed in your teacher education program (this includes all your education courses/experiences including CI/LAS 492) do you feel most helped you learn to teach effectively?

Please share any additional information that you feel would help us better understand your experience in the ISU teacher education program, including how you think it can be improved.



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